

## TWO NEW MEXICAN SPECIES OF *VIOLA*

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### ABSTRACT

Newly described here are the petite, white-flowered *Viola cochranei*, a morphologically isolated member of subsection *Stolonosae*, and the blue-flowered *V. oxyodontis*, a member of the *V. grahamii* Bentham complex in subsection *Mexicanae*. The first species is known only from southwestern Querétaro, in moist rocky soils of ravines along streams. The second species is widely distributed from southernmost Sinaloa to Michoacán and Guerrero, in oak-pine forests on the Neo-Volcanic Plateau.

### RESUMEN

Se describen como nuevas *Viola cochranei*, planta diminuta de flores blancas, aislada morfológicamente en la subsección *Stolonosae*, y *V. oxyodontis*, planta diminuta de flores azules, miembro del complejo *V. grahamii* Bentham en la subsección *Mexicanae*. La primera especie se conoce solamente del suroeste de Querétaro, en suelos pedregosos-húmedos en las cañadas al borde de los arroyos. La segunda especie tiene una distribución amplia, de la parte más sur de Sinaloa a Michoacán y Guerrero, en bosques de pino-encino en la planicie Neo-Volcánica.

KEY WORDS: Violaceae, *Viola*, México

During revisionary systematic studies of Mesoamerican *Viola*, approximately 36 species and species complexes have been delimited, including several distinctive undescribed taxa. Two of these, belonging to acaulescent subsections of section *Plagiostigma* (Godron) Kupffer, are described below.

***Viola cochranei* Ballard, sp. nov. (Fig. 1).** TYPE: MEXICO. Querétaro:

2 km al S de Puerto Alegriás, municipio de San Juan del Río, bosque de encino en cañada a la orilla de un arroyo, alt. 2000 m., planta herbácea de 5 cm de alto, flor blanca con venas moradas, fruto verde, abundante, 26 May 1986, Fernández N. 3929 (HOLOTYPE: NY; Isotypes, reportedly at CHAPA, ENCB, IEB, TEX; photos, WIS).

Plantae perennae, inter species sectionis *Plagiostigmatis* subsectionis *Stolonosarum* floribus parvibus albis et rhizomatis stoloni-formatis accedens, a *V. jalapaensis* Becker statuta patenter minore foliorum basi truncata vel vix cordata lamina anguste ovata marginis remote serratis recedit.

Acaulescent perennials to 9.5 cm tall; rhizome erect, woody, 1.5-3.0 cm long, 1.0-1.5 mm thick; stolons surficial or subsurficial, to 6 cm long and 1 mm thick, arising prostrately from the crown or a short distance below it, chlorophyllous the first year and with up to 2 small initial leaves, nonchlorophyllous and without leaves in subsequent years, with nodes rooting intermittently, the apex proliferating a rooting plantlet.

Leaves from the crown with stipules semi-herbaceous, free, lacerate with 3-several long gland-tipped segments, lanceolate, the inner and outer similar in size, 3.9-4.4 mm long; petioles of larger leaves 5-6.5 mm long; smaller blades ovate, truncate at base and obtusely pointed at apex, larger ones narrowly ovate, subcordate at base and acutely pointed at apex, 6-20 mm long and 5-18 mm wide, the margins distantly low-serrate, with 5-10 teeth on each side; blades of stolon leaves reniform, rounded-obtuse at apex, truncate at base, up to 5 mm long, 5 mm wide. Chasmogamous flowers 1-2; peduncles 1.5-9.5 cm long, its two bracts 2 mm long, 1/5-1/3 below apex; sepals eciliate, hyaline-margined, narrowly lanceolate to lance-linear, attenuate, the lowest 1.8-3.0 mm long and 0.7-1.1 mm wide, auricles 0.4 mm long; corollas 6-9 mm long, greenish-white in throat, petals cream-white, the laterals with one or two long purple-black nectar guides, the spurred petal with an extensive nectar guide network; spur broadly quadrate-rounded, exceeding auricles slightly, 0.7-1.0 mm long from apex to middle of base of lowest sepal; lateral and upper petals lance-ovate and narrowly rounded, the laterals glabrous or with a small tuft of filiform hairs within near the throat, the spurred petal broadly oblong-spatulate and truncate or slightly emarginate at apex; style scarcely

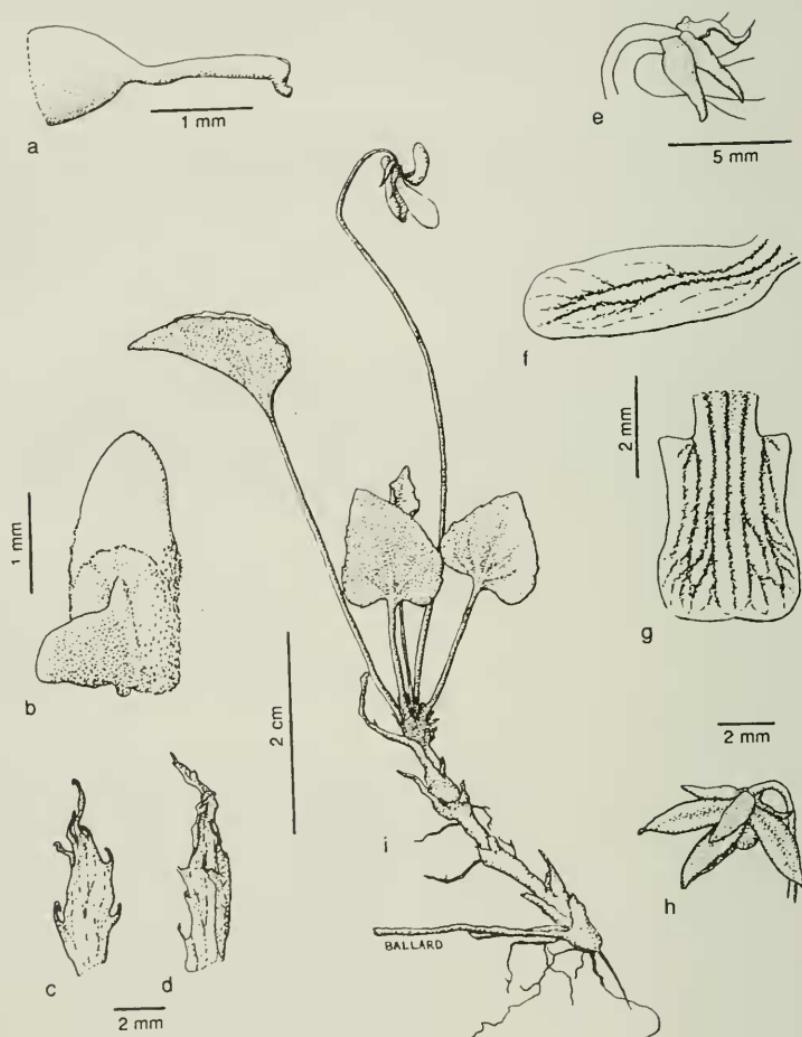


Fig. 1. *Viola cochranei* sp. nov.: (a) pistil; (b) stamen with nectary; (c) outer stipule; (d) inner stipule; (e) sepals in flower profile; (f) lateral petal, adaxial surface; (g) spurred petal, adaxial surface; (h) dehisced capsule with seeds; (i) flowering habit.

geniculate immediately above ovary, expanded slightly near apex, ending in a concavity flanked dorsolaterally by two inconspicuous wing-like protuberances and terminating ventrally in a short scoop-shaped, ventrally oriented stigmatic orifice; fruits 1 per crown.

Cleistogamous flowers with peduncles erect, 15 mm long. Capsules ovoid, green, 3-4 mm long; mature seeds not seen.

Paratypes: MEXICO. Querétaro: El Batán (camino a Amealco), encino, chaparral, tierras de cultivo, cerca de la presa, principio de la barranca de Amealco, sobre rocas, casi en el agua, 20 Apr 1980, Argüelles 1362 (IBUG); camino entre carr. a México y Amealco, Km. 18 aprox., tierras de cultivo y campo abierto, 2150 ms., fondo da la barranca, borde del río, arena, rojiza, *Taxodium mucronatum*, *Salix*, *Alnus*, fresno, *Quercus*, *Prunus*, laurel, 3 Apr 1977, Argüelles 749 (IBUG).

It is a pleasure to name this distinctive and handsome member of subsection *Stolonosae* in honor of Theodore S. Cochrane, who has made numerous contributions—so often “behind the scenes”, without credit to himself—to the floras of México and Wisconsin, and to our understanding of the taxonomy of the Cyperaceae and Capparidaceae.

While not a great geographic distance away from the related *Viola jalapaensis* Becker in Veracruz (Fig. 3), *V. cochranei* is quite different from all members of subsection *Stolonosae* in North and Middle America. It is distinguished by its narrowly ovate, remotely serrate, truncate to subcordate, glabrous leaves and thickish stoloniform rhizomes and stolons.

Thus far only three locations are known for *Viola cochranei*, all in southwestern Querétaro, from red rocky (limestone?) soils of ravines along streams at or above 2000 m elevation. The several sheets representing these stations were referred erroneously to *V. flagelliformis* Hemsley and *V. humilis* H.B.K. by Argüelles et al. (1991).

*Viola oxyodontis* Ballard, sp. nov. (Fig. 2)—TYPE: MEXICO. México: District of Temascaltepec: Nanchitila, llano, 15 Jun 1934, Hinton 6167 (HOLOTYPE: ARIZ; Isotypes: BM,F,US).

Plantae perennae, *V. grahamii* Bentham sectionis *Plagiostigmatis* subsectionis *Mexicanarum* affinis, cuius corollas violaceos suffusos stolones frondosus, distinguenda petalis apico rotundato petiolis quam laminis 3-5plo longioribus foliis perfecte glabris margino patenter acute serrato.

Acaulescent glabrous perennials, to 27 cm tall; rhizome upright to ascending, 8-30 mm long, 3.5-6.0 mm thick; stolons surficial, to 32 cm long, 1.5 mm thick, produced during anthesis from the crown, initially erect, later arching

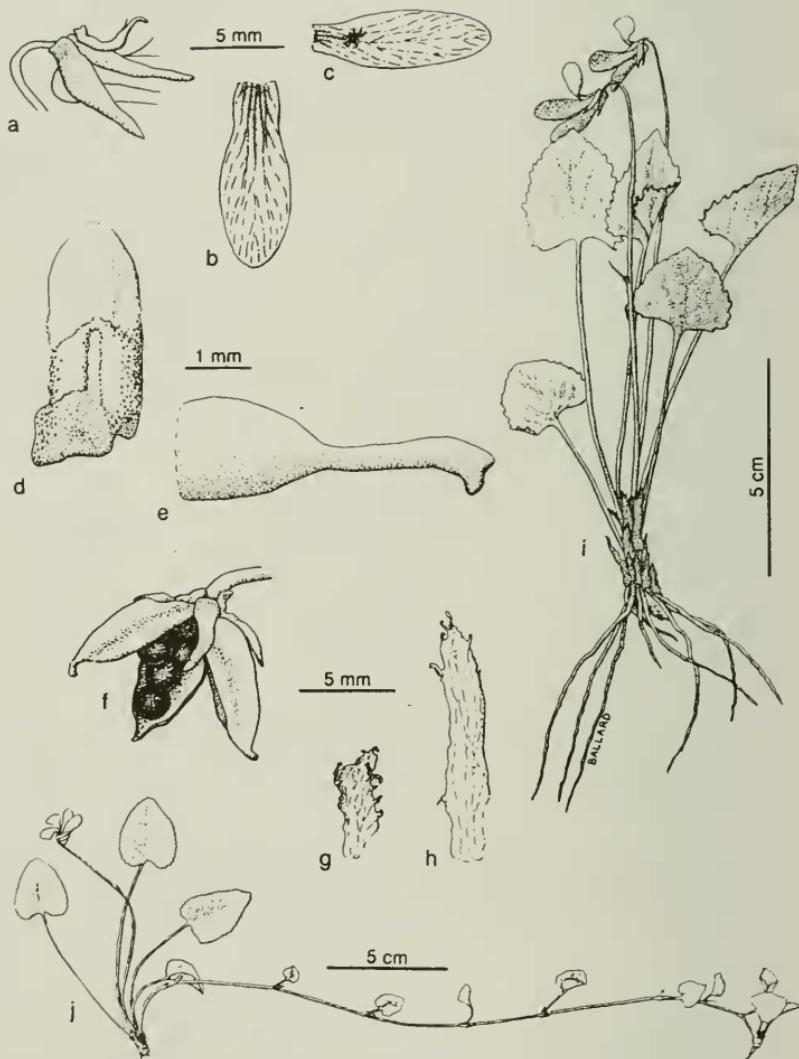


Fig. 2. *Viola oxyodontis* sp. nov.: (a) sepals in flower profile; (b) spurred petal, adaxial surface; (c) lateral petal, adaxial surface; (d) stamen with nectary; (e) pistil; (f) dehisced capsule with seed; (g) outer stipule; (h) inner stipule; (i) flowering habit; (j) stoloniferous plant.

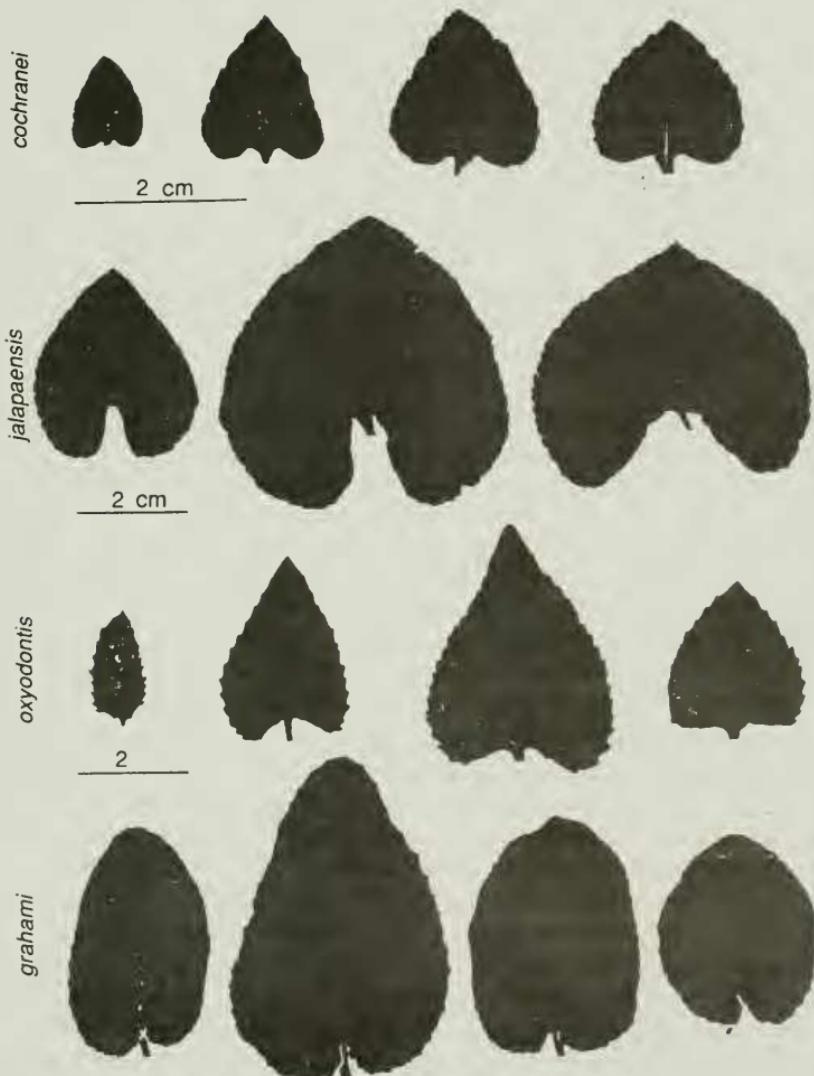


Fig. 3. Photocopies of leaves in four Mexican species of *Viola*, showing extremes of variation (left and right) and typical outline (center).

to become repent, generating 2-7 leaves along the nodes, with 1-2 nodes near est the parent occasionally leafless, and 1-2 flowers often produced at middle nodes, the shoot apex proliferating into a rooting plantlet.

Crown leaves with stipules semi-herbaceous, adnate to petiole for up to 2 mm, fimbriate, the outer lance-ovate to ovate, acute to attenuate at apex, 7-13 mm long, the inner lance-linear to lanceolate, attenuate at apex, 16-19 mm long; petioles of larger leaves 3-21 cm long; blades narrowly deltoid-triangular (or rarely lance-oblong) to broadly deltoid-ovate, broadly cuneate to subcordate at base and obtuse or acute to acuminate at apex, 2-5 cm long and 2.0-3.5 cm wide, one-half to one-fourth the length of the petiole, the margins distinctly and sharply spreading-serrate especially in the lowest third of the blade, the teeth here falcate and subacuminate; leaves and stipules of stolons similar to those of the crown but smaller, petioles 7-10 mm, blades ovate to broadly so, 5-18 mm long, 8-22 mm wide.

Chasmogamous flowers 1-5, peduncles 3.5-15 cm long, the two bracts 2-4 mm long, one-fourth to four-ninths of the peduncle length below apex; sepals eciliate, lance-linear, acuminate, the lowest 5.5-6.0 mm long, 1.5-1.6 mm wide, auricles 0.5-1.2 mm long; corollas 10-15 mm long, greenish-white in throat, petals nearly white or the lower 3 suffused with violet, the lateral and spurred petals bearing dark blue-violet nectar guides; spur narrowly rounded, scarcely exceeding the auricles, 0.5-1.0 mm long from apex to middle of base of lowest sepal; petals lance-ovovate and rounded or narrowly truncate, very rarely shallowly emarginate at the apex, the laterals 10-13 mm long, 2.5-4.0 mm wide, bearing a large tuft of filiform hairs within near the throat, the spurred petal ca. 11 mm long, 4-5 mm wide, glabrous within; style strongly geniculate immediately above the ovary, strongly expanded toward apex, ending in a concavity flanked dorsolaterally by two rounded wing-like protuberances, terminating ventrally in a short scoop-shaped stigmatic orifice; fruits all produced from crown.

Chasmogamous and cleistogamous capsules similar in morphology; peduncles erect, 4.5-14.5 cm long; sepals lanceolate to lance-linear, eciliate, 4-7 mm long, 1.0-1.3 mm wide; capsules long-ovoid, green (fresh) to tan (dry), 8-11 mm long; seeds shiny black at maturity, 1.9-2.2 mm long, 0.7-1.3 mm thick.

Paratypes. MEXICO. Guerrero: between Casahuates and small reservoir at head of waterfall above town on mountain west of and above Taxco, oak-wooded slopes and wet trailside banks, altitude 6200-6500 feet, 17 Aug 1948, Moore & Wood 4577 (A); Taxco, 12 Jul 1937, Abbott 233 (GH); Taxco, in oak forest, 23 Jul 1936, Abbott 165 (GH); Puerto Rico, Mina, pine forest, 1650 m., 1 Jul 1939, Hinton et al. 14374 (ARIZ,GH,US); Agua Zarca-Filo, Mina, pine forest, 30 Jun 1937, Hinton et al. 10479 (GH,MICH,US). Jalisco: south of Michoacán border, ca. 3 km NE and above Puerta El Zapatero (above Rancho El Terrero and 2.5 km S. of Espinal), along road from Jiquilpan to Ciudad Guzmán, 19°52'N 103°03'W, deep, moist, very shady, cool arroyos, clay soil,

along road from Jiquilpan to Ciudad Guzmán, in mountains, 30 Jul 1960, *Iltis*, *Koeppen*, & *Iltis* 547 (WIS); 17-18 km al E de C. Castillo, 3 km al NEE de Las Joyas, Estación Científica Las Joyas, Autlán, 19°35'19"N, 104°16'02"W, Vegetación secundaria, *Senecio*, *Rubus*, *Buddleia*, *Acacia*, *Zea*, 1800 msnm, 21 Jul 1988, *Santana* & *DeNiz* 3504 (ZEA); Tierritas Blancas, Predio Las Joyas, bosque de *Pinus*, 1800 msnm, 27 Oct 1985, *Ramos* 21 (IBUG); San Campus, Las Joyas, Mpio. de Autlán, bosque de pino con vegetación secundaria, *Pinus*, *Solanum*, *Quercus*, 13 Jul 1986, *Cuevas R.* 1323 (WIS); Sierra de Manantlán, ridge SW of Rincón de Manantlán, 19°35.5'N, 104°13.5'W, dry, open *Pinus oocarpa*-*Quercus* forest, the area had been burned and was grazed by cattle, but there was so little vegetation in the understory that the grazing was not obvious, 1600 m, 9 Jan 1980, *Kowal* 2825 (IBUG,WIS); Puerto de la Moza, Las Joyas, Autlán, bosque de pino y algunos encinos, *Pinus*, *Quercus*, *Agave*, 1900 msnm, 30 Jul 1985, *Vázquez* 3459 (WIS); 18-19 km al NE de Cuauhtlán, 1-2 km al NNE de El Zarzamoro, Picacho del Sol y La Luna, Autlán, 19°35'50"N, 104°16'14"W, bosque de *Pinus*, *Pinus herrerae*, *P. maximinoi*, *P. douglasiana*, 2150 msnm, 16 May 1990, *Guzmán* & *Hernández* 1016 (ZEA); Cerro de Tequila, bosque de *Pinus* y *Quercus*, 11 Aug 1968, *Villareal P.* 1618 (IBUG); km 17 de la terracería a Jilotlán de Dolores (Sierra de Halo), Mpio. Tecalitlán, bosque de pino y encino, 28 Oct 1988, *González C.* 49 (IBUG); 3.3 miles E of Route 110 on lumber road that begins 7.3 miles S of Tecalitlán, 19°28'N, 103°16'W, 1800 m, pine woods, red soil, 26 Jun 1974, *Wendt* & *Chiang* 325 (TEX); Sierra del Halo, near a lumber camp leaving the Colima highway 7 miles south-southwest of Tecalitlán and extending southeasterly, steep slopes in pine forest, in red clay soil, elevation 1530 m., 5 Aug 1957, *McVaugh* 16001 (MICH); Sierra del Halo, near a lumber road leaving the Colima highway 7 miles south-southwest of Tecalitlán and extending southeasterly, steep slopes in pine-oak forest, elevation 1400-1500 m., 23 Jun 1957, *McVaugh* 15012 (MICH); Mpio. Tecalitlán, 48 km. al S de Cd. Guzmán por carr. a Piuhuamo, luego 32 km al S de Llanitos por brecha a San Isidro y Mexiquillo, bosque de pino y encino, degradado, con dominancia de *Pinus douglasiana*, alt. 2080 m., 30 Jun 1988, *Gaona P.* 965 (MICH); El Fraile, Tapalpa, bosque de *Quercus* y *Pinus*, 2400 m., 26 May 1968, *Villareal P.* 1699 (IBUG); 5 km. al Noreste de Tapalpa camino a Chiquistlán, Mpio. Tapalpa, bosque de pinos y encinos, alt. 2100 msnm, 15 Jun 1985, *Soltero* & *González s.n.* (IBUG); steep mountainsides 4.5 miles north-northeast of Talpa de Allende, north of the road summit, in ravines, with oaks on the southeast-facing slopes and pines on the opposing slopes, elevation 1450-1500 m., 12 Oct 1960, *McVaugh* 20125 (MICH); 1-2 miles east of Tapalpa, rocky soil on broken hills, elevation 2100-2200 m., 1 Nov 1960, *McVaugh* 20549 (MICH); Cerro El Fraile, al NW de Tapalpa, Mpio. Tapalpa, bosque de pino-encino, asociado con *Pinus lumholzii*, *Quercus castanea*, *Q. obtusata*, *Arbutus glandulosa*, *Arctostaphylos pungens*, *Comarostaphylis discolor* ssp. *discolor*, 30 Jul 1986, *Ramírez Del-*

gadillo & Reyna Bustos 976 (IBUG); Sierra de Tapalpa (Cerro de Talcozagua), ca. 3 km. NNE of Tapalpa, on west-side of road to Laguna Sayula at ca. km. 29, 19°58'N, 103°45'W, top, ridges, and crevices of large NE-facing (50 m) steep basalt (?) cliffs, with scattered *Pinus* and *Quercus*, in rich loose soil, 18 Jun 1984, Iltis 29169 (IBUG,WIS); Mpio. Concepción de Buenos Aires, 26 km. al E de Cd. Guzmán, carr. a Tamazula, y 33-40 km por brecha de Vista Hermosa a C. de B. Aires, bosque de pino y encino, degradado, con dominancia de *Pinus oocarpa*, alt. 1900-2060 m., 5 Jul 1988, Gaona P. 986 (MICH); 2 km. antes de llegar a las Pilas camino a Manantlán, Cuautitlán., bosque mesófilo de montaña, entremezclado con encinares, *Quercus*, *Ardisia*, *Miconia*, 1800 m., 9 Jul 1985, Vázquez 9999 (ZEA); Pte. de Guadelupe, Mpio. Ixtlahuacán del Río, matorral subtropical, 800 m., 19 Jul 1975, Villarreal 7667 (IBUG); El Terrero, on route 110 at km. 59-60, about 20 mi. due WSW of Jiquilpan, Mich., & several miles beyond Mazamitla, Jal., in relatively undisturbed pine forest, 18 Jun 1956, Gregory & Eiten 91 (MICH); Volcán Tequila, due south of Tequila, woods of *Quercus*, and also *Pinus* and *Arbutus* in some places, summit, rim of ancient crater, elev. 2750 m., 11 Aug 1968, Anderson & Anderson 5115 (MICH); Cerro de Tequila, Mpio. de Tequila, bosque de encino y pino en ladera de cerro, 2000 m., 12 Jul 1971, González T. 212 (MICH); Mpio. Tequila, [Cerro de la Torre de] microondas del Cerro de Tequila, bosque de *Quercus laurina* y *Q. rugosa*, 2800 m., 18 Jul 1990, Ramírez Delgadillo, Tamayo, & Portillo Mtz. 2087. (IBUG); Cerro de Tequila, Mpio. de Tequila, bosque de encino en ladera pedregosa, 2750 m., 13 Jul 1971, González T. 229 (MICH); Rancho la Calaverna 25 km al NE de Zapotlán Mpio. de Gómez Farías, bosque de pino y encino, suelos lateríticos arenosos con buen drenaje, 1800 m, 25 Jun 1980, Trujillo F. 5 (IBUG); Ladera N del Cerro de Tequila, Mpio. de Tequila, cerca de la Tetilla, bosque de *Pinus* sp., *Quercus rugosa*, *Q. fulva* y *Juniperus* sp. suelos forestales degradados, 2800-2950 m., 7 Jul 1977, V. de Puga & Carvajal 10528 (IBUG). México: 8 km NE of Temascaltepec on road to Toluca, 19°5'N; 100°00'W, oak-pine forest with bunch grass understory and many herbs with bulbous underground storage organs including *Oxalis*, *Cyperus seslerioides*, *Begonia* and liliaceous plants, 11 Jul 1969, Marcks & Marcks 1144b (WIS); Ypericones, Temascaltepec, llano on top, 28 Jun 1935, Hinton et al. 7940 (B,GH); Nanchititla, District of Temascaltepec, llano, 11 Oct 1933, Hinton 4986 (B); Cañada de Nanchititla, ladera húmeda, bosque mixto de encinos y pinos, en 1600 m. de alt., 25 May 1954, Matuda et al. 30813 (IBUG). Michoacán: 17 m N of Aguililla on road to Dos Aguas, pine-oak woods; elevation 1820 meters, 8 Aug 1972, Denton 2030 (MICH); Pto. Zarzamora, Coalcomán, pine forest, 2 Jul 1939, Hinton et al. 13876 (ARIZ,GH,LL,US). Sinaloa: 60 road miles NE of Mazatlán on Mex. 40 to Durango mid-way between villages of Santa Lucía and Potrerillos, 23°27'N; 105°48'W, oak forest with many shrubs and grasses on SE facing slopes of Sierra Madre Occidental, alt. ca. 1600 m., 21 Jul 1969, Marcks & Marcks 1188 (WIS).

As a representative of the *Viola grahamii* complex, *V. oxyodontis* (Greek *oxys*, sharp and *odontis*, with teeth, for the spreading-serrate margins of well developed leaves) is morphologically well-marked, and widely distributed throughout southwestern and south-central México. It ranges from the Mazatlán area in southernmost Sinaloa south to Aquillala in Michoacán, thence eastward to Taxco in Guerrero, largely on the Neo-Volcanic Plateau. According to label data, it frequents oak and pine forests in relatively dry sandy, rocky or clay soils, often in sparsely vegetated sites and mostly above 1400 meters elevation.

Milo Baker evidently suspected it to be an undescribed species in the late 1940s, annotating several sheets as "*Viola triangularis* ined.". Norman Russell also annotated sheets in the mid 1960s as something unknown to him. Systematic studies of the *V. grahamii* complex in progress, including examinations of type material for the names *V. ciliata* Schlecht. non R. & S., *V. grahamii* Bentham, *V. reptans* Robinson, and *V. schaffneriana* Becker, have revealed *V. oxyodontis* to diverge from other taxa in the complex (Fig. 3) in numerous characteristics of foliage, flowers, capsules, and seeds. Diagnostic features include strictly glabrous foliage; leaves with long petioles and truncate-based blades, often sharply acute to acuminate at the apex and narrowly to broadly ovate-triangular in outline; blade margins sharply spreading-serrate; sepals sharply acuminate at the apex; and petals commonly rounded or truncate at the apex.

The remainder of the complex ranges mostly southeast of *Viola oxyodontis* but is sympatric with it in Jalisco. A sheet at MICH (McVaugh 15012) has specimens of both *V. oxyodontis* and *V. grahamii* s.l., indicating that the two taxa are occasionally sympatric. A very few specimens with sparsely villous petioles, otherwise resembling the new species, have been collected in the zone of sympatry and probably represent hybrids with *V. grahamii* s.l.

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